The ABCs of Evidence-Based Practice for Teachers

Allison G. Kretlow and Sharon L. Blatz

Celeste *is a first-year special education teacher at Wyatt Elementary School. She completed 2 weeks of intensive professional development just before school started, learning about the materials to be used for the school's new reading program for kindergarten and first grade. She then spent 2 days of professional development on writing strategies and another on inclusion strategies. While setting up her new classroom, she also found a bookshelf full of workbooks, reading materials, manipulatives, computer programs, and textbooks. Almost all of the materials she received in training and the programs on the shelf in her room are prominently labeled as "research-based." Celeste is not sure which materials to use with her new students.*

Gerard *has been teaching special education for 8 years at Jefferson High School and is in his second year as department chair. At the beginning of the school year, Gerard's administration informed the faculty that using evidence-based practices was a priority, and teachers would need to develop a way to document this in lesson plans. As the special education department chair, it will be Gerard's job to ensure that the practices he and his colleagues are using are "evidence-based." Gerard has always believed the methods he uses with his students are effective, as most of his students perform well on classroom tests and end-of-year standardized exams. Gerard is unsure how he will find research that supports the practices and programs he is using, let alone assist his colleagues in the special education department to do this as well.*

Both Celeste and Gerard are overwhelmed about how to be certain the programs, materials, and strategies they use with their students are evidence-based. In her preservice program, Celeste learned how to use some evidence-based programs and strategies, such as peer-assisted learning, direct instruction, and strategic instruction; however, she doesn't have those programs in her classroom, and must make decisions about the materials she has. Gerard, on the other hand, has been using a set of strategies for the last 8 years, but isn't sure how to verify that they are evidence-based. Gerard and Celeste are facing the same situation as many other teachers trying to make decisions about how to select the most effective instructional practices. So, how do teachers make sense of evidence-based practice?

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Why Do Teachers Need to Know About Evidence-Based Practice?

By now, every educator is familiar with the buzzwords *evidence-based practice*, *research-based practice*, and *scientifically based instruction*. Federal laws such as the No Child Left Behind Act of 2001 (NCLB, 2006) and the Individuals With Disabilities Education Act (IDEA, 2008) require teachers to use evidence-based practices (20 U.S.C. § 6301[9]; 20 U.S.C. § 1401[c][5][E] and [F], respectively). Based on these federal policies, the federal government's research arm (Institute of Education Sciences, IES) and special education's professional organization, the Council for Exceptional Children (CEC) developed guidelines for determining whether or not a practice is evidence-based (CEC, 2008; Coalition for Evidence-Based Policy, CEBP, 2003).

Although this process appears linear on paper, both the IES (CEBP, 2003) and the CEC (2008) guidelines may be difficult for practitioners to interpret, as they are similar but not identical (Odom et al., 2005). These requirements for using evidence-based practices lead directly to myriad questions for teachers about which programs, practices, strategies, and materials to use with their students (see box, "Questions Teachers Have About Evidence-Based Practices").

Questions Teachers Have About Evidence-Based Practices

How do I know the programs I have are based on high-quality research?

How do I find a program or teaching strategy that is evidence-based?

This program says it's "research-based"—but how do I know if the research included students like mine?

How do I determine whether the evidence-based practice I'm using is working with my students?

What do I do if my students do not make progress in an evidence-based program?

The outcome of these decisions is critical: The selection of programs and practices teachers use is one of the most important factors in student achievement (CEBP, 2003). Therefore, educators need efficient ways to separate the wheat from the chaff—in other words, to determine which available tools are based on high-quality research and most likely will impact critical student outcomes (Stanovich & Stanovich, 2003). Whereas educational researchers and teacher educators develop, evaluate, and disseminate evidence-based practices, teachers are primarily responsible for the delivery of instruction; they are where the "rubber meets the road," and where most difficulties occur in the implementation of evidence-based practice (i.e., *research-to-practice gap*; Gagnon & Maccini, 2007; Greenwood & Abbott, 2001; Maccini & Gagnon, 2006; Schumaker et al., 2002).

Teachers report positive attitudes about research, but it appears that few actually use evidence-based practices in the classroom (Burns & Ysseldyke, 2009; Williams & Coles, 2007). Although complex factors impact the research-to-practice gap, teachers have

reported two salient barriers to using educational research: lack of time to search and lack of access to sources (Williams & Coles, 2007). In the same study, many teachers also reported not feeling confident finding research information independently (Williams & Coles, 2007). Although researchers have free access to research journals and online databases through university libraries, most teachers do not, nor do they have time in the school day to spend searching and reading reports of research (Beach et al., 2007). Given the critical role of teacher in selecting evidence-based practices, teachers need to know how to locate information about evidence-based practices, as well as how to strengthen their use of any program or practice in the classroom.

Understanding Evidence-Based Practice

Although most teachers are not researchers, a basic understanding of research concepts can help them evaluate a potential practice or program (Stanovich & Stanovich, 2003). The most critical concepts for teachers to understand are the differences between *scientifically based*, *research-based*, and *evidence-based*. These three terms are often used synonymously, although their meanings are distinctly different in critically important ways.

Scientifically Based Research

NCLB (2006) refers repeatedly to "scientifically based research." *Scientifically based research* describes the methods used to test instructional practices, and the general guidelines include (a) systematic cause-and-effect research design using observable, measurable outcomes; (b) replication by other scientists; and (c) approval by a panel of independent experts before publication (*peer review*; 20 U.S.C. 7801[37]; Stanovich & Stanovich, 2003; Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005). This term is used to outline the quality indicators of research that must be present in order for a particular practice or program to be evaluated for general use (American Educational Research Association, 2009). In other words, according to federal policy, scientifically based research methods must be used in answering the question "What is most likely to work?"

Research-Based Practices

The term *research-based*, on the other hand, is the broadest of the three terms, and is used to describe programs or practices that have been studied in some way, but not necessarily using all of the quality indicators of scientifically based research. *Research-based* can refer to a single study that has not been replicated, designs that do not allow an evaluation of cause and effect, small numbers of participants, examinations of contextual variables such as teacher or student preferences, and studies that may or may not have been vetted by an independent panel of experts.

According to federal policy, scientifically based research methods must be used in answering the question "What is most likely to work?"

For example, a researcher develops a new reading program, tests it with a class of second graders from one suburban school, and has positive results. The researcher also conducts interviews with teachers who really like using the program. The researcher writes a report of findings, submits it to an educational journal, and the article is published. Although the researcher tested the program using a recognized research design (i.e., single-group pretest-posttest design), the study did not include a control or comparison group and was never replicated. Therefore, the study is research, but does not meet the federal criteria for scientifically based research. In other words, this particular research provides little evidence of *generalizability*—it is unclear whether the results are likely to be replicated if used in another teacher's classroom.

The term *research-based* can also be used to describe studies that provide preliminary data on the effectiveness of a program or practice. For example, Wanzek and Vaughn (2009) reported the effects of an intensive reading intervention for three students who had persistent reading difficulties despite receiving 90 minutes of small-group direct instruction for at least 12 weeks. Wanzek and Vaughn used case-study methodology, which by nature includes a very small number of participants. Because few studies have examined this type of intensive intervention, the case studies provide preliminary data useful in designing future replications and studies with larger groups of participants, but the data are not as useful in answering the larger question, "What is likely to work?"

Evidence-Based Practice

The key concepts in understanding the term *evidence-based practice* are type and magnitude of research (Odom et al., 2005). *Type* of research refers to the systematic way researchers apply an intervention and measure its effectiveness. IES (CEBP, 2003) and CEC (2008) agree that the type of research must be quantitative, which means the effects of the intervention must be measurable (e.g., improved reading scores on the Woodcock-Johnson; Woodcock, McGrew, & Mather, 2001). In addition, IES and CEC agree that the intervention must show a clear cause-and-effect relationship with improved outcomes. Typically, studies demonstrate cause and effect by using a control or comparison group. Because of the small numbers and heterogeneous settings in special education, control/comparison groups are not always feasible; therefore, CEC also recognizes evidence derived from smaller numbers of students, if the studies are sufficiently replicated (i.e., *single-subject research*; Horner et al., 2005).

The second component of evidence-based practice is magnitude of studies. *Magnitude* refers to the amount of

studies that show a strong, positive cause-and-effect relationship between an intervention and improved academic or behavioral outcomes. Magnitude is evaluated through *research synthesis*, by examining the effects of a collection of studies that leads to consensus about the effectiveness of a particular program, practice, or set of practices. The National Reading Panel (NRP, 2006) serves as an excellent example of evaluating magnitude of evidence through research synthesis. The NRP conducted a comprehensive search for all research that (a) focused on children's reading development from preschool to Grade 12 (measured numerically), (b) used an experimental design with a control or comparison group or a single-subject design, and (c) was published in a peer-reviewed journal. After retrieving the studies, NRP statistically calculated the overall effects of particular instructional methods across the components of reading, in order to provide recommendations about which methods were most likely to work. *Synthesis methodology* such as the kind used by the NRP is the crux of what separates "research-based" from "evidence-based." Government agencies, professional organizations such as CEC, and individual researchers conduct and publish research syntheses, and their findings are available to teachers. But often, teachers do not know how to locate this information.

I Understand "Evidence"—Now What?

To make things more confounding for teachers, understanding "evidence" is only about a third of the battle. The second challenge for teachers is to either find a new practice or program that suits their students, or evaluate practices/programs readily available to them. Then, teachers face the challenges of implementing the practice in a way that leads to maximum achievement gains for students. When making decisions about evidence-based practices, remembering the "ABCs" of evidence-based practice may be helpful to teachers (see box, "The ABCs of Evidence-Based Practice").

The ABCs of Evidence-Based Practice

- **A** Access evidence-based practices.
- **B** Be careful with fidelity.
- **C** Check student progress.

A Access Evidence-Based Practices

Although it is important for studies to be published in research journals, the fact is, most of these journals are not read by teachers (Beach et al., 2007). However, studies have demonstrated that many teachers use the Internet regularly to plan lessons (68% on a weekly basis; Becker, 1999); according to the National Center for Education Statistics (2005), over 90% of teachers access the Internet daily in schools. In addition, studies have shown that electronic access to information about effective practices can increase the likelihood of teachers completing particular teaching activities (Kay, Knaack, & Petrarca, 2009; Ohlund, Andrews, Yu, Jannasch-Pennell, & Diangi, 1999).

To help combat the issue of access to information about evidence-based practices, several organizations have created free, online databases that offer evaluations of the research evidence for various teaching programs and practices along with recommendations for use (e.g., "potentially positive effects," "use with caution," "top-rated program"). The sites provide descriptions of programs and practices emphasizing key points of implementation. These databases allow teachers, administrators, parents, and other practitioners to search for evidence-based practices and programs across content areas or evaluate the extent of evidence for programs they may already access. There are four web sites in particular that are helpful for accessing information about evidence-based practices (see Table 1). It is important to note that this list is not exhaustive; there are many other web-based resources on evidence-based practices (see box, "Additional Online Resources"). The four sites presented in Table 1 provide information on a range of programs and practices across content areas and student populations, although each is unique in focus. Understanding the focus and structure of each site will enable teachers to more efficiently find the information that best suits their students and setting.

Differences in Determining "Evidence"

Each web site has a unique set of criteria for determining "evidence." Although all of the sites adhere to the broad standards for determining evidence, each differs in small ways, such as the number of studies that must be conducted and the amount of progress students in a study have to make. It is important for teachers to have a basic understanding of how

Additional Online Resources

The IRIS Center for Training Enhancements http://iris.peabody.vanderbilt.edu/index.html	Modules offer video clips of instructional strategies, sample lessons, and materials as follow-up support for teachers.
Florida Center for Reading Research http://www.fcrr.org/	Instructional materials include scripted examples of lessons across the components of reading for K–12 students.

Table 1. Web Sites for Information on Evidence-Based Practices

Web Site	Target Audience	Setting/ Student Population	Topic Areas	Rating System	Review Process	Print Resources
What Works Clearinghouse (U.S. Department of Education Institute of Education Sciences) http://ies.ed.gov/ncee/wwc/	Teachers Administrators Researchers Policy makers	General education Students with learning disabilities Struggling learners English language learners	Adolescent literacy Beginning reading Character education Dropout prevention	Positive effects (+ +) Potentially positive effects (+) Mixed effects (+ –) No discernible effects (0) Potentially negative effects (–) Negative effects (––)	Stage One (studies screened and selected based on strength of research design) Stage Two (strength of evidence, using quality indicators of scientifically based research) Stage Three (consistency across studies)	Practice guides Intervention reports Topic reports How to use brochures
Best Evidence Encyclopedia Johns Hopkins University School of Education http://www.bestevidence.org/	Teachers Administrators Researchers Policy makers	General education Struggling learners English language learners	Mathematics Reading Comprehensive school reform	Strong evidence Moderate evidence Limited evidence (modest effects) Limited evidence (weak effects) No qualifying studies	Stage One (studies screened and selected based on strength of research design) Stage Two (studies exhibit quality indicators for scientifically based research; must use K–12 students for at least 12 weeks)	Research area reports Educator's summaries
Promising Practice Network on Children, Families and Communities Rand Corporation http://www.promisingpractices.net/	Teachers Administrators Researchers Policy makers School psychologists Parents Behavior specialists Other professionals	General and special education Students with and without disabilities	School safety School readiness School success Strong families	Proven practice Promising practice Screened practice	Stage One (studies screened and selected based on strength of research design) Stage Two (studies exhibit quality indicators for scientifically based research; must use children and/or families)	Research summary briefs Fact sheets
Current Practice Alerts Teaching LD: Information & Resources for Teaching Students With Learning Disabilities http://www.teachingld.org/ld_resources/alerts/default.htm	Teachers Administrators Researchers Policy makers School psychologists Parents Behavior specialists Other professionals	General and special education Students with high-incidence disabilities	Reading Writing Math Behavior Assessment	"Go for it" (practice has solid evidence of effects) "Use caution" (negative effects, or not enough studies)	Stage One (practice warrants review based on established prominence in professional circles) Stage Two (studies reviewed for quality indicators for scientifically based research)	Practice Alert (research summary)

each site determines evidence in order to make the most informed decisions when selecting a program, practice, or strategy to use with students.

The rating system for each database is unique, so it is also important to read and understand it before looking at the final recommendations. Across all sites, the ratings give an indication of the extent and strength of the evidence for a particular program, practice, or strategy. In general, each site categorizes the evidence from low (i.e., no studies meet the criteria or few studies with limited effects), moderate (i.e., potentially positive effects/promising practice), or high (i.e., high-quality studies show strong effects). Figures 1 and 2 provide screen-shot examples of what resources are available, along with tips on navigating the sites.

Most Useful Resources for Teachers

All four web sites have program and practices rating lists and research summaries, which are helpful to determine whether or not to select a particular practice or program. In addition to research summaries, each site offers additional products and resources to support implementation. These products can be downloaded, saved to a computer, or printed as a permanent reference.

However, each of these web sites only tells teachers how well a practice or program has worked in previous studies; there is no guarantee that it is the best selection for students in your classroom. Most sites have *limiters* that allow users to narrow the population prior to searching for research reports. Selecting a practice or program that has strong evidence for the specific population a teacher works with is a great place to start, but to increase the likelihood of students getting the maximum benefit teachers must also maintain fidelity of implementation.

B Be Careful With Fidelity

Selecting the appropriate evidence-based practice is important, but the quest for improved achievement does not end there. Once a teacher begins using any evidence-based practice, fidelity with the components and teaching procedures is key to maximizing student achievement (Furtak et al., 2008; Kovaleski, Gickling, Morrow, & Swank, 1999). *Fidelity* refers to accuracy, exactness, or a strict adherence to details. When applied to instruction, fidelity means adhering to the details of the practice or program that make it effective.

Some research has shown a strong link between high fidelity and

Figure 1. Navigating the What Works Clearinghouse Web Site

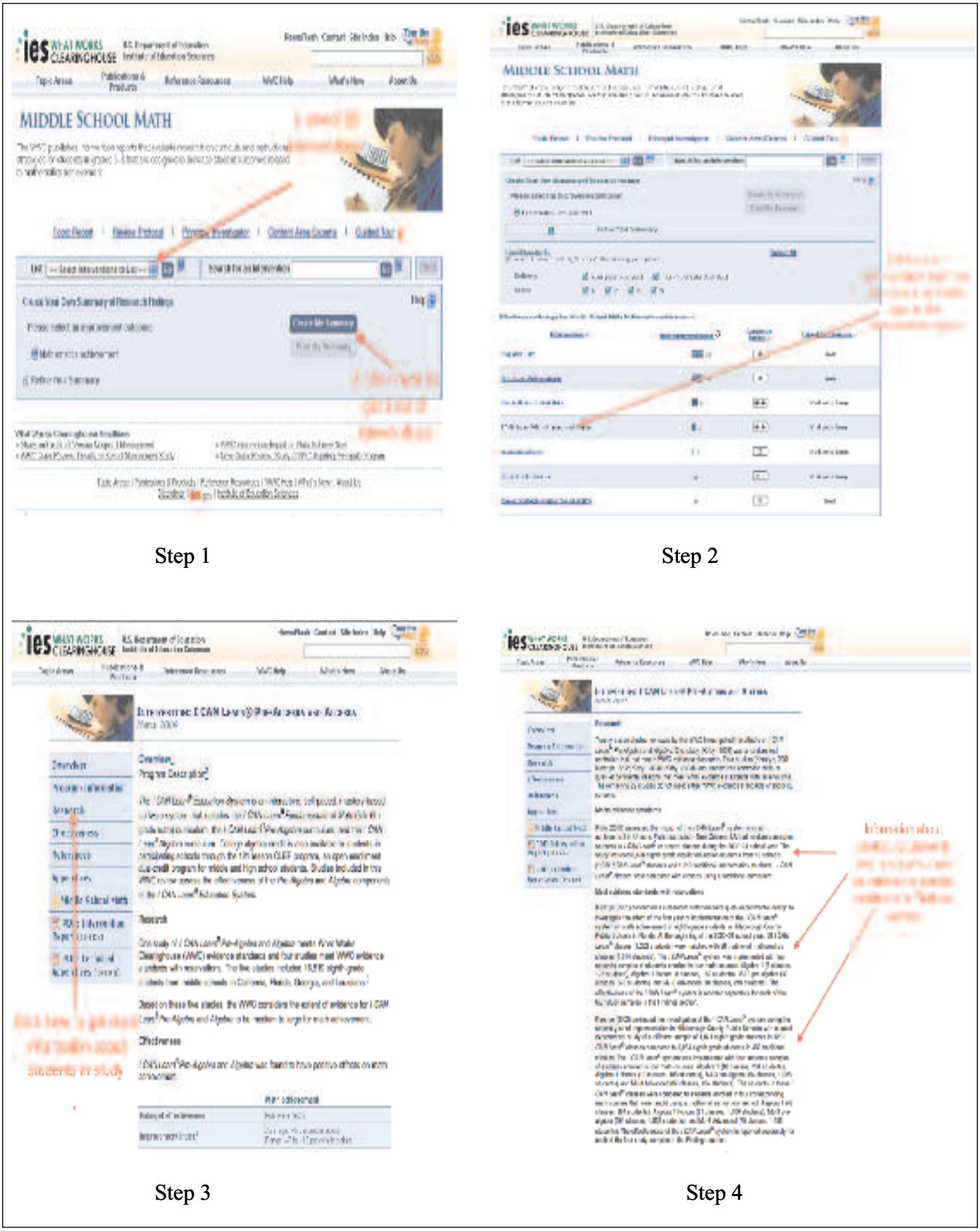
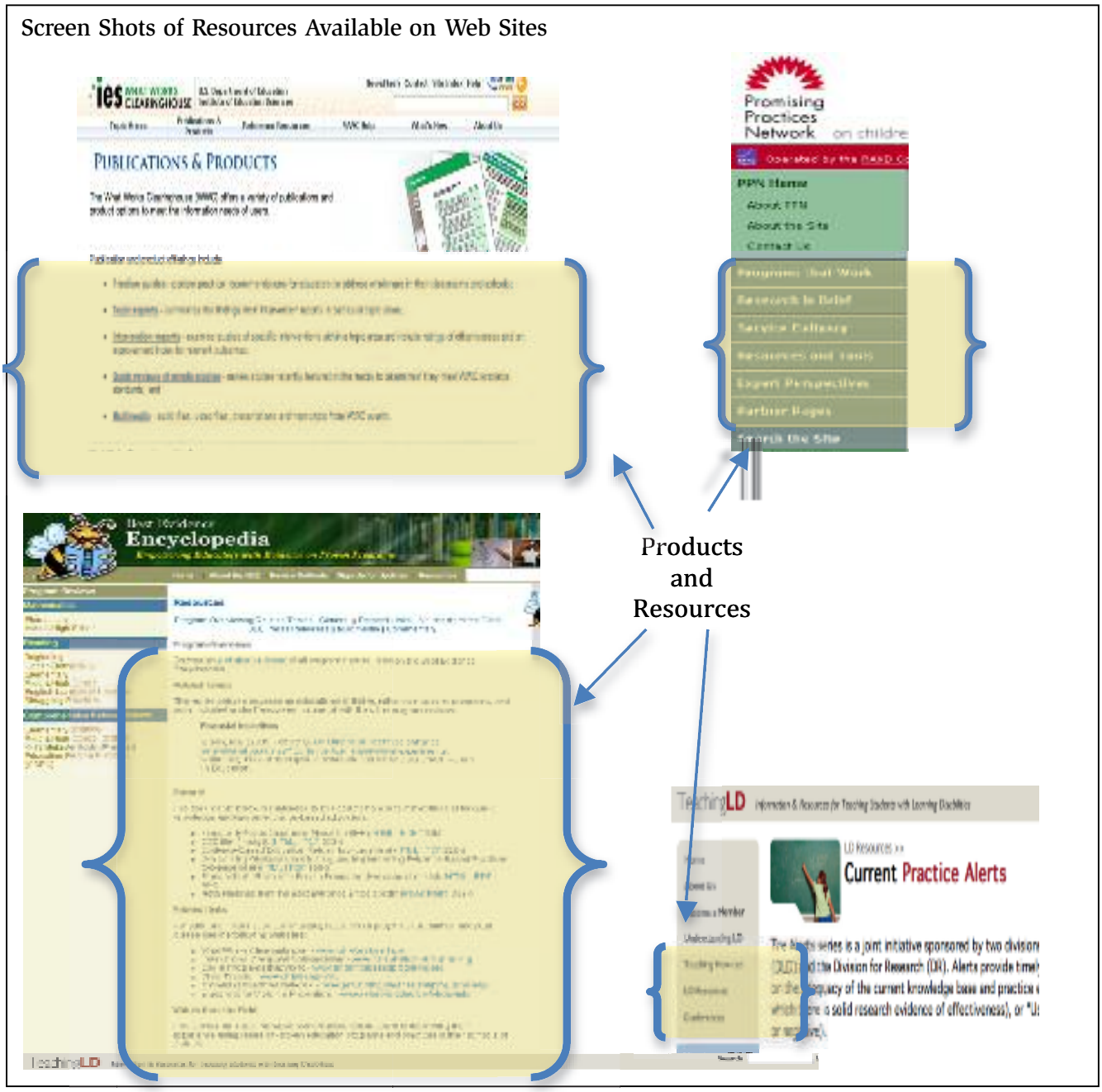


Figure 2. Screen Shots of Internet Resources on Evidence-Based Practice



improved academic achievement. For example, studies by Furtak et al. (2008) and Kovaleski et al. (1999) demonstrated that students performed poorly when teachers inconsistently implemented instructional practices. In other words, picking and choosing program components or substantially modifying teaching procedures correlated with lower gains in student achievement.

The practice of classwide peer tutoring (CWPT) provides an excellent example of the importance of fidelity. CWPT is considered an evidence-based practice based on several organizations' criteria (IES, 2007; Maheady, Harper, & Mallette, 2003; Promising Practices Network, 2009). Many studies have demonstrated that the components of CWPT (see box, "Components of Classwide Peer Tutoring") are essential to its effectiveness (Arreaga-Mayer, 1998; Stein et al., 2008). Therefore, to set students up for success using CWPT, teachers should maintain fidelity with the components that have made it effective in the past, which means not eliminating steps or substantially changing procedures. For example, without teacher monitoring during CWPT sessions, students might provide incorrect feedback to one another, thereby repeatedly practicing incorrect answers. Similarly, with incorrect pairing procedures students might not be able to tutor one another due to differences in current academic level of performance.

Components of Classwide Peer Tutoring

Weekly pretest and strategic pairing of students

Training student dyads or triads how to tutor one another

Instruction organized in weekly units

Teacher modeling of new concepts using explicit, systematic instruction

Scripted or structured 30-minute reciprocal tutoring sessions with teacher monitoring and feedback

Awarding and public posting of points

Weekly posttest

Weekly team restructuring

One strategy for improving teacher fidelity of implementation is peer support, particularly in the form of instructional coaching. Teachers who are new to implementing an evidence-based practice typically need extensive follow-up support to achieve high levels of fidelity (Buzhardt, Greenwood, Abbott, & Tapia, 2007). A growing body of research has demonstrated that in-classroom coaching can substantially improve the fidelity of evidence-based practices (Kretlow & Bartholomew, 2010). Most school districts use some form of an instructional coaching model, with many schools housing at least one lead teacher responsible for supporting the implementation of new practices (Bean, Cassidy, Grumet, Shelton, & Wallis, 2002). Seeking out the support of a peer with more experience implementing a particular evidence-based practice is one way to shore up fidelity.

The important take-away point for teachers is that following the instructions in the teaching manual of a program, following the steps provided in training, or following the procedures from a research article are critical to improving student achievement. Of course, given the individualized nature of instructing students with disabilities, teachers often must make modifications and accommodations to meet the needs of different students. Most research recommends that if teachers must modify a prescribed intervention, they should modify only one variable at a time, while closely examining frequent progress monitoring data (Bursuck & Damer, 2007).

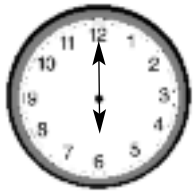
C Check Student Progress

Regardless of the selected practice or program, teachers need to know whether or not students are making progress. One of the most validated ways to measure improvement is *progress monitoring*, and, even more specifically, *curriculum-based measurement* (CBM; Foegen, Jiban, & Deno, 2007; Wayman, Wallace, Wiley, Tichá, & Espin, 2007). CBM is easy to implement and highly effective at informing teachers about the effectiveness of instruction (Stecker, Lembke, & Foegen, 2008), although it differs from typical classroom assessments (e.g., mastery tests).

Typical classroom assessment tests a specific sequence of skills (e.g., single-digit multiplication) taught in a period of time (e.g., weekly pretest/posttest). Mastery tests such as these are useful in informing teachers whether or not a student can perform a specific skill set

Figure 3. Sample First-Grade Weekly CBM Quiz

1. Write the time shown on the clock.



_____

2. Write the total number of tallies you see.

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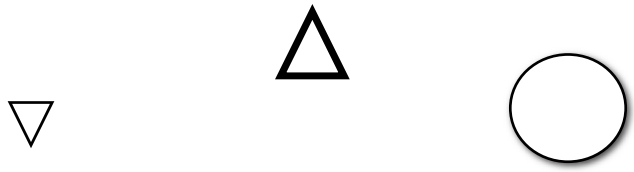
3. 2 + 7 = _____

4. 6 – 4 = _____

5. Write the total value of the coins.

6. Circle the shape that matches this one:



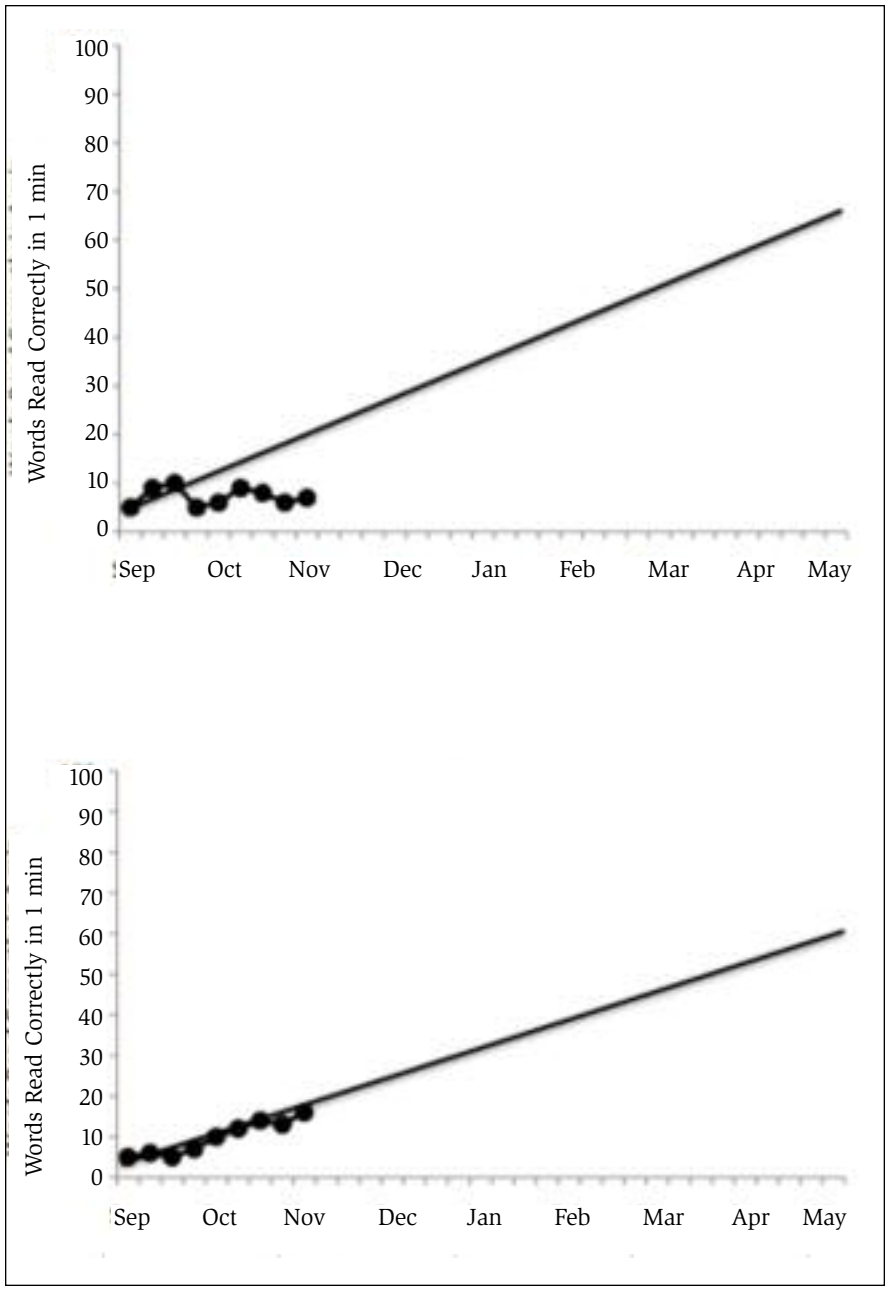
in a brief period of time, but do not provide teachers with an overall picture of progress toward a goal. CBM addresses these problems by sampling skills across a curriculum. More specifically, CBM involves administering frequent, brief quizzes (e.g., weekly, biweekly, monthly), and measuring a student's individual progress against an established grade-level or individualized education program (IEP) goal, typically using a line graph.

For example, a hypothetical first-grade math curriculum includes (a) counting objects in a set of 1 to 100 and writing the numeral; (b) counting forward by 1's, 5's, and 10's; (c) recalling basic addition and subtraction facts (1–10); (d) solving one-step addition/subtraction story problems; (e) determining the value of coins; (f) telling time to the half-hour; and (g) describing and sorting plane geometric figures. Figure 3 provides an example of a weekly CBM quiz to assess student mastery of the curriculum.

The basic steps of conducting CBM include:

1. Define the component skills of the IEP goal or state curriculum.
2. Locate existing quizzes that sample the skills.
3. Establish the student's baseline level.
4. Set up a line graph.
5. Draw a goal line on the graph. Many skills have established benchmarks for the grade level.
6. Continue to instruct the student using an evidence-based practice or program (and remember B—be careful with fidelity).
7. Give students frequent CBM quizzes and graph their data. Having students graph their own data is a great way to improve motivation, self-determination, and goal-setting skills.
8. Use the data to determine whether or not to adjust your instruction.

Figure 4. Sample CBM Line Graphs



CBM involves administering frequent, brief quizzes . . . and measuring a student's individual progress against an established grade-level or individualized education program (IEP) goal.

In general, between four and eight data points are enough to decide whether the instruction is working or not. Figure 4 depicts how to determine whether or not a student is making adequate progress toward a goal. In the top graph, the student is not making progress toward the goal line after eight weekly CBM quizzes. The teacher should implement a change in instruction. In the bottom graph, the student is making progress toward the goal line. In fact, in March the student's data are above the goal line, in which case the teacher raised the goal for April and May.

Table 2. Online CBM Resources

Web Site	Quiz Resources/ Grade Level	Cost
Dynamic Indicators of Early Literacy Skills (DIBELS) https://dibels.uoregon.edu/	1-min literacy quizzes: phonemic awareness, alphabetic principle, fluency, vocabulary, comprehension Grades K–6	Teachers can sign up for a free account with access to all materials. Graphs can be hand-drawn on quiz booklets. $1 per student buys access to the data management system
AIMSWeb http://www.AimsWeb.com	Literacy quizzes: phonemic awareness, alphabetic principle, fluency, vocabulary, comprehension Math quizzes: numeracy, math concepts/ applications Writing quizzes: written expression, spelling Grades K–8	Complete set of all quizzes can be purchased for $5.00 per student
Intervention Central www.interventioncentral.org (Click on "CBM Warehouse")	Literacy quizzes: phonological awareness, oral reading fluency, word lists, comprehension Math quizzes: numeracy, computation, advanced operations Writing quizzes: words spelled correctly writing sequences Grades K–8	Free Includes charting spreadsheets and preformatted progress monitoring graphs

There are many sources for teachers of CBM quizzes that have already been deemed reliable, and valid measurement tools for reading, math, and writing. Table 2 highlights three web sites where teachers can find CBM quizzes to use with students.

Final Thoughts

It is critical teachers adhere to federal policies regarding evidence-based practices. Quickly identifying and effectively using evidence-based programs and practices is particularly important for special educators, because students in special education often already have academic or behavioral deficits. Using evidence-based practices with fidelity and ongoing progress monitoring gives students with disabilities the best chance at achieving their goals. The ABCs presented here give teachers a few ways to gain confidence in their selection and delivery of effective instruction for students with disabilities.

Using evidence-based practices with fidelity and ongoing progress monitoring gives students with disabilities the best chance at achieving their goals.

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Allison G. Kretlow *(Virginia CEC), Assistant Professor; and* **Sharon L. Blatz** *(Virginia CEC), Assistant Professor, Department of Exceptional Education, James Madison University, Harrisonburg, Virginia.*

Correspondence concerning this article should be addressed to Allison Kretlow, Department of Exceptional Education, James Madison University, MSC 6908, 395 South High Street, Harrisonburg, VA 22939 (e-mail: kretloag@jmu.edu).

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